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C L A I M S

1. A process for the removal of hydrogen sulphide, mercaptans and optionally carbon dioxide and carbonyl sulphide from a gas stream comprising hydrogen sulphide, mercaptans and optionally carbon dioxide and carbonyl sulphide, by removing in a first step most of the hydrogen sulphide, part of the mercaptans and optionally part or most of the carbon dioxide and carbonyl sulphide by washing the gas stream with an aqueous washing solution comprising 10 to 45 wt% based on total solution of water, 10 to 40 wt% based on total solution of a physical solvent and 20 to 60 wt% based on total solution of an amine, which first removal step is followed by a second removal step in which mercaptans are removed by means of molecular sieves, in which process the amount of mercaptans which is removed by the aqueous washing stream is between 60 and 96 wt% (of total removed mercaptans in steps one and two), and the amount which is removed by the mol sieves is between 40 and 4 wt% (of total removed mercaptans in step one and two).

2. A process according to claim 1, in which the total gas stream comprises 0.05 to 20 vol% hydrogen sulphide, 10 to 1500 ppmv mercaptans and 0 to 40 vol% carbon dioxide, preferably 0.1 to 5 vol% hydrogen sulphide, 20 to 1000 ppmv mercaptans and 0 to 30 vol% carbon dioxide.

3. A process according to claim 1 or 2, in which the total gas stream comprises hydrogen sulphide in an amount between 0.15 and 0.6 vol%.

4. A process according to any of claims 1 to 3, in which the ratio between the amount of mercaptans (expressed as

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ppmv) and the amount of hydrogen sulphide (expressed as vol%) is at least 50, more preferably at least 100, more preferably at least 200.

5 5. A process according to any of claims 1 to 4, in which the gas stream is natural or associated gas.

6. A process according to any of claims 1 to 5, in which the physical solvent is sulfolane.

10 7. A process according to any of claims 1 to 6, in which the amine is a secondary or tertiary amine, preferably an amine compound derived from ethanol amine or a mixture thereof, more preferably DIPA, DEA, MMEA, MDEA, or DEMA, most preferably DIPA or MDEA or a mixture thereof.

15 8. A process according to any of claims 1 to 7, in which the aqueous washing solution comprises 20 to 35 wt% based on total solution of water, 20 to 35 wt% of a physical solvent and 40 to 55 wt% of an amine.

20 9. A process according to any of claims 1 to 9, in which the gas stream obtained in the first step is cooled to a temperature between 5 and 45 °C, preferably between 10 and 35 °C, where after any condensate is separated from the gas stream.

25 10. A process according to any of the preceding claims, in which the first step is carried out at a temperature of at least 20 °C, preferably between 25 and 90 °C, more preferably between 30 and 55 °C, at a pressure between 15 and 90 bara.

30 11. A process according to any of the preceding claims, in which in the second step a crystalline molecular sieve is used, preferably a sieve having an average pore diameter of 5 ångström or more, especially about 6 ångström.

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12. A process according to any of the preceding claims,
in which the second step is carried out at a temperature
of 25 °C and a pressure between 15 and 90 bara.

5 13. A process according to any of the preceding claims in
which the regeneration gas of the second step containing
mercaptans is remixed with the starting gas stream or is
treated in a dedicated absorber.